



# ULDB Technology Workshop

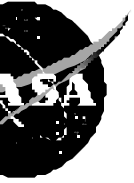
ULDB

Wallops Flight Facility

## ULDB Balloon Vehicle and Recovery Systems

Ultra-Long Duration Balloon Workshop

June 24-25, 2014

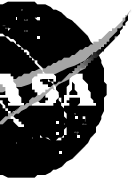


## Current LDB Vehicle

UL

Wallops Flight

- **Suspended Weight to 8000 lbs**
- **Altitude to 130,000'**
- **Duration Limits ~7 days (Non-Polar) to ~24 days (Polar)**
- **Diurnal Excursion 5 kft to 40 kft (Wx)**

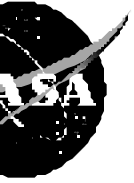


# ULDB Vehicle Functional Requirements

UL

Wallops Flight Facility

- **Duration to 100 days (Non-Polar)**
- **Suspended Weight ~ 3000 lbs**
- **Altitude 120,000 - 130,000'**
- **Diurnal Excursion < 5000' (Non-Polar)**
  - **Science**
  - **Survival**



# ULDB Vehicle Design Requirements

ULDB

Wallops Flight Facility

- **Long Duration Survival**
  - materials
  - systems
- **Altitude Control**
- **Mission**
  - Launch
  - Trajectory (Ground Track)
  - Termination



# ULDB Vehicle Technology Development

UL

Wallops Flight Facility

- **Materials**
- **Fabrication**
- **Vehicle Diurnal Altitude Control**
- **Structural Design/Testing**
- **Mission Technology**

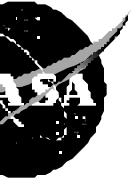


# ULDB Materials Technology Issues

UL

Wallops Flight Facility

- **Strength to Weight**
- **Radiative Properties**
- **Manufacture**
- **Fabrication**
- **Exposure**
- **(Cost)**

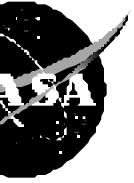


# ULDB Fabrication Technology Issues

ULDB

Wallops Flight Facility

- **Seaming**
- **Fitting Installation**
- **Quality Control**
- **Cost**
  - machinery development
  - labor



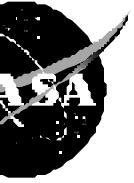
# ULDB Altitude Control Technology Issues

ULDB

Wallops Flight Facility

- **Pressurization (Super Pressure)**
- **Gas Thermal Control**
  - active
  - passive
- **Ballast**
- **Direct Volume Control**



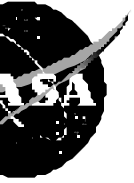


# **ULDB Structural Design Technology Issues**

UL

Wallops Flight Facility

- **Weight Minimization**
- **Load Transfer**
- **Manufacturing Flaws**
- **Fitting Design**
- **Material Characterization**
- **Launch and Ascent Modeling**
- **Testing**

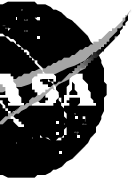


# ULDB Mission Technology Issues

ULDB

Wallops Flight Facility

- **Launch**
- **Trajectory Control**
- **Termination**
- **Recovery (Envelope)**

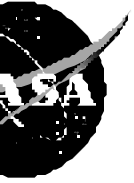


# Current Recovery System

UL

Wallops Flight Facility

- **Unpacked Circular Chutes**
- **< 20 ft/s Vertical Impact Velocity**
- **Up to 150' Diameter**
- **Released at Float/ No Reefing**
- **Very High Reliability**
- **Impact Zone Determined by Descent Vector**

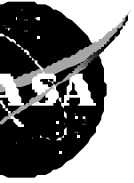


# ULDB Recovery System Functional Requirements

ULDB

Wallops Flight Facility

- **< 3000 lbs from 130,000'**
- **Safety**
  - Remote Planned, <20 ft/s Vertical, proper CE
  - Accuracy, proper CE
- **Payload Protection**
- **Flexible**
- **Water/Land Recovery**

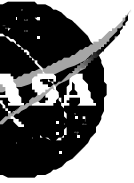


# ULDB Recovery System Design Requirements

ULDB

Wallops Flight Facility

- **100 Day Exposure**
- **Integrated in Flight System**
- **Gondola Integrated Design Elements**
- **Autonomous Capability**
- **High Reliability**
- **Cost**



# **ULDB Recovery System Technology Development**

ULDB

Wallops Flight Facility

- **Water Impact**
- **Water Recovery**
- **Balloon System Integration**
- **Location Aids**
- **Payload Protection (e.g. chute cutaway)**
- **Mission Recovery Planning**